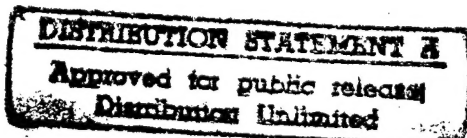


EXECUTIVE SUMMARY

ENERGY SAVINGS OPPORTUNITY SURVEY
FOR DESIGNATED FACILITIES
AT VARIOUS U.S. ARMY INSTALLATIONS
OAHU, HAWAII

PREPARED FOR:

Department of the Army
Pacific Ocean Division
Corps of Engineers



19971016 032

PREPARED BY:

R. M. Towill Corporation
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AUGUST 1987

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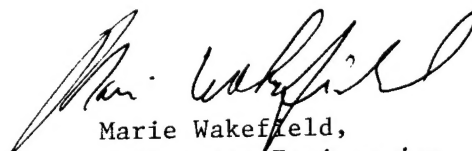


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August 31, 1987

Commander
U.S. Army Engineer Division
Pacific Ocean
ATTN: PODED-FM
Bldg. 230
Fort Shafter, Hawaii 96858-5440

Gentlemen:

SUBJECT: Energy Savings Opportunity Survey for
Designated Facilities at Various
U.S. Army Installations, Oahu, Hawaii
Contract No. DACA83-86-D-0101, D.O. 0001

We are pleased to submit eighteen (18) copies of the Executive Summary and Final Report for the subject project. The distribution of these copies has been made to the parties as specified in Annex B of the Scope of Work.

Should you have any questions related to this submittal, please call us at (808) 524-8200.

Very truly yours,


Yang Jin Kim, P.E.
Vice President

YJK:G-1
Encl: Executive Summary and
Final Report (18)

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LIST OF REFERENCES

1. Army Facilities Energy Plan, 9 December 1984.
2. Engineer Technical Letters (ETL's):
 - a. 1110-3-254 Use of Electric Power for Comfort Space Heating
 - b. 1110-3-282 Energy Conservation
 - c. 1110-3-294 Interior Design Temperatures
 - d. 1110-3-332 Economic Studies
3. DOD Construction Criteria Manual 4270.1-M
4. Technical Manuals
 - a. TM5-785 Engineering Weather Data
 - b. TM5-800-2 General Criteria Preparation of Cost Estimates
 - c. TM5-800-3 Project Development Brochure
5. Army Regulations:
 - a. AR415-15 Military Construction Army (MCA) Program Development
 - b. AR415-17 Cost Estimating for Military Programming
 - c. AR415-20 Project Development and Design Approval
 - d. AR415-28 Department of the Army Facility Classes and Construction Categories
 - e. AR415-35 Minor Construction, Emergency Construction, and Replacement of Facilities Damaged or Destroyed
 - f. AR420-10 General Provisions, Organization Function, and Personnel
 - g. AR5-4 Department of the Army Productivity Improvement
Change No. 1 Program
6. Engineer Improvement Recommendation System (EIRS) Bulletin 84-01, dated 29 June 1984 and Tri-Service Military Construction Program (MCP) Index for FY87 Program dated 4 January 1985.
7. OCE Letter DAEN-ZCF-U, Energy Conservation Investment Program (ECIP) Guidance, dated 11 June 1986.
8. Specified Facility Energy Studies for Energy Engineering Analysis Program (EEAP) at U.S. Army Support Command, Hawaii (USASCH) Installations, June 1987, by W.A. Hirai & Associates, Inc.

LIST OF ABBREVIATIONS

A/C	Air Conditioning
ASHRAE	American Society of Heating Refrigeration and Air Conditioning
COE	Corps of Engineers
DHW	Domestic Hot Water
DOD	Department of Defense
ECIP	Energy Conservation Investment Program
ECO	Energy Conservation Opportunity
EEAP	Energy Engineering Analysis Program
ESOS	Energy Savings Opportunity Survey
EWH	Electric Water Heater
FY	Fiscal Year, October 1 Thru September 30
HVAC	Heating, Ventilating and Air Conditioning
KW	Kilowatt
KWH	Kilowatt-Hour
LCCA	Life Cycle Cost Analysis
LPG	Liquified Petroleum Gas
MBTU	Million British Thermal Unit
OH&P	Overhead and Profit
POD	Pacific Ocean Division
SIR	Savings-Investment Ratio
SNG	Synthetic Natural Gas
SOW	Scope of Work
SPP	Simple Payback Period
TM	Technical Manual
UPW	Uniform Present Worth
USASCH	U.S. Army Support Command, Hawaii

EXECUTIVE SUMMARY

1. OBJECTIVE

This Energy Savings Opportunity Survey (ESOS) is to identify Energy Conservation Opportunities (ECO's) which are practical and economical for the reduction of energy consumption in accordance with the Army Facilities Energy Plan. This survey involves only designated facilities at various U.S. Army Installations.

2. SCOPE OF WORK

The work to be performed under this project includes the following tasks:

- a. Coordinate with the on-going and proposed energy projects.
- b. Conduct a limited site survey to identify applicable ECO's and obtain necessary data to evaluate the ECO's.
- c. Evaluate applicable ECO's to determine the feasibility in accordance with current ECIP guidance.
- d. Prepare complete programming and implementation documentation for the implementation of recommended projects.
- e. Prepare a comprehensive report to document the work performed including energy analyses, the results and recommendations.

The facilities covered under this survey are listed on Table 1.

3. ENERGY CONSERVATION OPPORTUNITIES

During the field investigation, each designated facility was carefully examined to identify the applicable ECO's which are to be evaluated for their implementation. The text of ECO's was taken from the listed ECO's in Annex A of the Contract Scope of Work. Some of those ECO's are not applicable to the facilities covered under this study. The following are INAPPLICABLE ECO's and their reasons:

- a. Insulation: Temperature gradients between ambient air and conditioned air are too small to make any U-factor improvement practical. Previous study revealed that Savings-Investment Ratio (SIR) for this ECO was 0.31 or less.
- b. Storm Windows or Double Glazing: Same as item a.
- c. Insulated Panels: Same as item a.
- d. Vestibules: Previous study revealed that SIR for this ECO was 0.40 or less.
- e. Load Dock Seals: No loading dock is involved in this study.
- f. Reduction of Glass Area: Previous study revealed that SIR for this ECO was 0.31 or less.
- g. Replace Kitchen Light Fixtures: Energy efficient fluorescent fixtures are already installed.
- h. Shutdown Energy to Hot Water Heaters or Modify Controls: This ECO is inapplicable to the facilities except lowering H.W. temperature controls which is recommended as a maintenance item.
- i. Improve Power Factor: Base-wide power factor improvement already has been implemented.
- j. High Efficiency Motor Replacement: This ECO is not feasible for small horsepower motors in the designated facilities.
- k. Night Setback/Setup Thermostats: This ECO is inapplicable for the facilities as no heating is required and air conditioning is to be cut off in lieu of temperature setup.
- l. Infrared Heaters: No heating is required.

- m. Economizer Cycle: Due to the tropical climate, utilization of outside air for space cooling is not feasible because of high temperature and humidity of outside air during the operational period.
- n. Control Hot Water Circulating Pump: No heating is required.
- o. FM Radio Controls: Radio control of building energy system is not practical for small building energy systems involved in this study.
- p. Decentralize Domestic Hot Water Heaters: Domestic hot water systems are already decentralized.
- q. Reduce Air Flow: All A/C systems are small constant air volume systems and no energy savings are expected by reducing air flow.
- r. Prevent Air Stratification: This ECO is inapplicable to cooling.
- s. Boiler Oxygen Trim Control: No boiler is involved in this study.
- t. Revise Boiler Controls: No boiler is involved in this study.
- u. Chiller Replacement: Existing chiller is operating satisfactorily and no replacement is warranted.
- v. Replace Absorption Chiller: No absorption chiller is involved in this study.
- w. Insulate Steam Lines: No steam system is involved in this study.
- x. Return Condensate: No condensate system is involved in this study.

- y. Domestic Hot Water Heat Pumps: Most of the domestic hot water heaters use SNG gas which is already at a low cost and heat pumps offer no significant advantage. The facilities where electric water heaters are provided have very low hot water demands (offices) and do not offer enough savings for the ECO.
- z. Transformer Overvoltage and Loading: By clarification of the scope of work, these ECO's are not included.
- aa. Occupancy Sensors to Control HVAC: The ECO is applicable only to single private rooms with its own A/C system. The A/C systems for the facilities in this study include multiple rooms of various functions, therefore, this ECO is not applicable. The timeclock control is more suitable for the control of A/C systems in this study.
- ab. Occupancy Sensors to Control Lighting: The use of occupancy sensors to control lights for facilities involved in this study is not feasible for the following reasons:
 - (1) Many of the facilities involved practice energy conservation by turning off lights for rooms not in use.
 - (2) For smaller rooms, replacement of wall toggle switch with a motion sensor switch cannot be justified unless the occupant frequently forgets to turn off the light several nights per week.
 - (3) Many large rooms have interior partitions that would require several motion sensors and relays resulting in substantially higher initial cost.

- (4) Location of switches must be carefully selected to avoid direct light sources (for infrared type), minimize dead spots which may cause lights to turn off when occupants are present, etc.

Some applicable ECO's which can be implemented by installation maintenance personnel using regular maintenance and repair funds are classified as maintenance items. The following is the list of ECO's recommended as MAINTENANCE ITEMS:

- a. Weatherstripping on doors and windows.
- b. Reflective film on windows.
- c. Close doors which are open between conditioned area and non-conditioned area.
- d. Resetting thermostats at proper temperature.
- e. Install insulating blankets on electric water heaters.
- f. Install flow restricting devices on showers.
- g. Repair of damaged insulation on equipment and piping.
- h. Clean or replace clogged air filters.
- i. Repair smashed coil fins.
- j. Delamp fluorescent fixtures where lighting level is excessive.
- k. Turn off unnecessary lighting and exhaust fans.
- l. Clean lighting fixture lenses and lamps.

After careful evaluation, the following ECO's are selected as Applicable ECO's:

- a. Architectural ECO's
 - A-1 Storm Windows for Jalousie Windows
 - A-2 Drop Ceilings
 - A-3 Insulated Overhead Door

b. Mechanical ECO's

- M-1 Timeclock Control for A/C Systems
- M-2 A/C Heat Recovery Systems
- M-3 Make-Up Air for Exhaust Hoods

c. Electrical ECO's

- E-1 Replace Incandescent Fixtures With Fluorescent Fixtures
- E-2 Replace Incandescent Fixtures With HPS Fixtures (Interior)
- E-3 Replace Incandescent Fixtures With HPS Fixtures (Exterior)
- E-4 Time Switch Control for Exterior Lighting
- E-5 Photo Switch Control for Exterior Lighting

Table 2 shows the matrix of applicable ECO's and the building numbers for which the ECO is applicable.

4. ENERGY AND LIFE CYCLE COST ANALYSIS

All applicable ECO's for the designated facilities were evaluated for their economic feasibility for implementation in accordance with the latest criteria. The evaluation process includes energy and other savings analysis, project cost estimate and life cycle cost (LCC) analysis to determine the cost effectiveness. Cost effective projects are those for which the Savings-Investment Ratio (SIR) is 1.0 or greater.

The evaluated ECO's are listed on Table 3 by their SIR rank. Table 3 also shows the estimated construction cost, annual energy savings in MBTU and dollars, SIR and Simple Payback Period (SPP) for individual ECO's.

5. PROJECT SUMMARY AND RECOMMENDATIONS

As shown on Table 3, the recommended projects for funding are twenty-seven (27) projects that represent a total construction cost of \$126,460, annual energy savings of 1,022.62 MBTU, and total annual savings of \$26,469. Their average SIR is 2.10 and SPP is 8.3 years. For these projects, the implementation documents (DA Form 4283) have been prepared. FY87 OMA Fund will be applied for the implementation of these projects.

Ten (10) ECO's failed to qualify as cost effective projects because their SIR's were lower than 1.0: four (4) architectural ECO's including storm windows and drop ceilings; five (5) electrical ECO's including time and photo switches for exterior lighting; and one (1) mechanical ECO, heat recovery system. The average SIR is 0.50 and SPP is 40.2 years.

As illustrated by the results of this study, energy conservation opportunities must be concentrated on the direct improvements of energy systems such as air conditioning and lighting systems.

The field survey also identified numerous maintenance items which can be implemented by installation maintenance personnel. They include items such as weatherstripping, cleaning filters of A/C units and resetting or recalibrating of thermostats. These maintenance items have been recommended previously as a part of the Field Investigation Report.

6. BUILDING ENERGY END-USE

The building energy end-use was analyzed for individual designated facilities to estimate the present annual energy consumption. This annual energy consumption rate becomes a baseline for calculating the energy savings attributed to applicable ECO's. Each building's energy end-use is broken down into the categories of air conditioning, lighting, domestic hot water and other equipment. Table 4 shows the results of building energy end-use analysis including present energy consumption, energy savings by recommended projects and projected energy consumption after implementation of recommended projects for each facility and category. Figure 1 shows the same results in graphic form.

The summary of energy end-use is as follows:

Present Energy Consumption:	MBTU/YR	\$/YR
Electricity	16,479.20	\$362,048
SNG	770.05	7,562
LPG	36.06	349
Total	17,285.31	\$369,959

Savings by ECO's:

	MBTU/YR	\$/YR
Electricity	926.37	\$ 20,352
SNG	70.70	694
LPG	0	0
Total	997.07	\$ 21,046

Projected Energy Consumption:

Electricity	15,552.83	\$341,696
SNG	699.35	6,868
LPG	36.06	349
Total	16,288.24	\$348,913

TABLE 1 (Sht 1 of 2)

LIST OF BUILDINGS INCLUDED IN THIS SURVEY

<u>BLDG. NO.</u>	<u>DESCRIPTION</u>	<u>CATEGORY CODE(S)</u>	<u>AREA (SF)</u>
FORT SHAFTER:			
P-405	Maintenance Shop & Administration Facility	21885 61050	(20,461) (8,745) 29,206
SCHOFIELD BARRACKS:			
P-844	Enlisted Men's Dining Facility	72210	22,291
P-672	Enlisted Barracks w/o Dining	72111	14,100
P-673	Laboratory	53020	14,136
P-676	Hospital Clinic	51020	9,840
P-677	Hospital Clinic	51020	14,400
P-678	Enlisted Barracks w/o Dining	72111	14,400
P-679	Admin. Gen. Purpose	61050	6,531
P-680	Enlisted Barracks w/o Dining	72111	14,876
P-681	Hospital Clinic	51020	11,270
P-682	Hospital Clinic	51020	13,800
P-683	Medical Admin.	61025	6,580
P-684	Dental Clinic	54010	14,490
P-685	Hospital Clinic	51020	13,500
P-686	Hospital Clinic	51020	14,700
P-687	Enlisted Barracks w/o Dining	72111	14,700
P-688	Enlisted Barracks w/o Dining	72111	14,400

TABLE 1 (Sht 2 of 2)

LIST OF BUILDINGS INCLUDED IN THIS SURVEY

<u>BLDG. NO.</u>	<u>DESCRIPTION</u>	<u>CATEGORY CODE(S)</u>	<u>AREA (SF)</u>
P-691	Pharmacy and Medical Supplies	55090	4,390
P-360	DMMC Class I & III	61023	12,274
P-584	Bowling Center	74011	9,331
P-580	Division Headquarters Bldg.	61012	<u>88,786</u>
		SUBTOTAL	328,795

FORT DERUSSY:

190	Army Reserve Center	17140	27,245
191	Army Reserve Center	17140	5,290
192	Motor Repair Shop	21410	<u>6,092</u>
		SUBTOTAL	38,627

WHEELER AIR FORCE BASE:

1003	Flight Simulator Building	17110	<u>5,500</u>
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TOTAL: 25 Buildings		402,128
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TABLE 2

INSTALLATION & BLDG NO.		APPLICABLE ECO'S										
		A-1	A-2	A-3	M-1	M-2	M-3	E-1	E-2	E-3	E-4	E-5
FS	P-405				X			X				
SB	P-844				X		X	X			X	
SB	P-672									X	X	
SB	P-673									X		X
SB	P-676	X			X							
SB	P-677									X	X	
SB	P-678					X				X	X	
SB	P-679											
SB	P-680											
SB	P-681											
SB	P-682											
SB	P-683											
SB	P-684	X			X							
SB	P-685											
SB	P-686											
SB	P-687									X	X	
SB	P-688									X		X
SB	P-691											
SB	P-360	X	X					X		X	X	
SB	P-580				X			X				
SB	P-584											
FD	190				X	X		X	X			
FD	191				X			X				
FD	192											
WAF	1003			X								

A-1 STORM WINDOWS FOR JALOUSIE WINDOWS
 A-2 DROP CEILINGS
 A-3 INSULATED OVERHEAD DOOR
 M-1 TIME CLOCK CONTROL FOR A/C SYSTEM
 M-2 A/C HEAT RECOVERY SYSTEMS
 M-3 MAKE-UP AIR FOR EXHAUST HOODS
 E-1 REPLACE INCAND FXTR W/FLUORESCENT FXTR
 E-2 REPLACE INCAND FXTR W/HPS FXTR (INTERIOR)
 E-3 REPLACE INCAND FXTR W/HPS FXTR (EXTERIOR)
 E-4 TIME SWITCH CONTROL FOR EXTERIOR LIGHTING
 E-5 PHOTO SWITCH CONTROL FOR EXTERIOR LIGHTING

NOTE:

1. FS, SB, FD, AND WAF DENOTES: FORT SHAFTER, SCHOFIELD BARRACKS, FORT DeRUSSY, AND WHEELER AFB RESPECTIVELY.

TABLE 3

LIST OF PROJECTS RANKED BY SIR

BLDG NO.	ECO NO.	PROJECT DESCRIPTION	CONSTRUCTION COST (\$)	ENERGY SAVINGS (MBTU/YR)	TOTAL SAVINGS (\$/YR)	SIR	SPP
=====							
RECOMMENDED PROJECTS							

P-844	M-1	TIME CLOCK, A/C	\$8,074	346.96	\$7,623	9.26	1.1
P-360	E-1	INCAND - FLUOR LT	\$1,148	8.58	\$384	4.14	3.0
P-844	E-1	INCAND - FLUOR LT	\$7,356	38.37	\$2,199	3.66	3.4
191	E-1	INCAND - FLUOR LT	\$5,735	38.03	\$1,688	3.65	3.4
190	E-1	INCAND - FLUOR LT	\$5,464	34.88	\$1,560	3.54	3.5
P-676	M-1	TIME CLOCK, A/C	\$1,041	16.49	\$362	3.41	2.9
P-580	E-1	INCAND - FLUOR LT	\$8,988	38.70	\$2,218	3.02	4.1
190	E-2	INCAND - HPS, INT	\$11,720	79.68	\$2,278	2.45	5.3
P-405	E-1	INCAND - FLUOR LT	\$1,293	3.46	\$248	2.29	5.3
P-580	M-1	TIME CLOCK, A/C	\$4,343	141.67	\$915	2.07	4.8
P-688	E-3	INCAND - HPS, EXT	\$6,800	18.86	\$823	1.48	8.4
190	M-1	TIME CLOCK, A/C	\$8,386	56.00	\$1,244	1.45	6.9
P-688	E-5	PHOTO SWITCH, EXT	\$551	1.43	\$60	1.34	9.4
P-678	M-2	A/C HEAT RECOVERY	\$9,748	70.64	\$694	1.25	14.4
P-678	E-4	TIME SW, EXT LT	\$539	1.24	\$52	1.19	10.6
P-672	E-4	TIME SW, EXT LT	\$539	1.20	\$50	1.14	11.0
P-405	M-1	TIME CLOCK, A/C	\$2,270	12.06	\$265	1.14	8.8
P-844	M-3	KITCHEN EXH HOOD	\$4,380	22.62	\$497	1.11	9.0
P-687	E-3	INCAND - HPS, EXT	\$6,533	12.88	\$561	1.05	11.9
P-672	E-3	INCAND - HPS, EXT	\$8,000	15.81	\$690	1.05	11.8
P-678	E-3	INCAND - HPS, EXT	\$8,393	16.40	\$715	1.04	12.0
P-684	M-1	TIME CLOCK, A/C	\$1,041	4.97	\$109	1.03	9.7
P-673	E-3	INCAND - HPS, EXT	\$307	0.59	\$26	1.03	12.1
P-677	E-3	INCAND - HPS, EXT	\$4,259	8.20	\$358	1.02	12.2
P-360	E-3	INCAND - HPS, EXT	\$3,060	5.86	\$256	1.02	12.2
191	M-1	TIME CLOCK, A/C	\$1,041	7.85	\$172	1.00	13.2
1003	A-3	OVERHEAD DOOR	\$5,451	19.19	\$422	1.00	13.2

TOTAL			\$126,460	1022.62	\$26,469	2.10	8.3

NON-RECOMMENDED ECO'S

P-687	E-4	TIME SW, EXT LT	\$511	0.97	\$42	0.99	12.4
P-844	E-4	TIME SW, EXT LT	\$510	1.42	\$33	0.84	15.8
P-677	E-4	TIME SW, EXT LT	\$511	0.62	\$27	0.64	19.3
190	M-2	A/C HEAT RECOVERY	\$7,564	27.87	\$270	0.62	28.6
P-684	A-1	STORM WINDOWS	\$468	0.75	\$16	0.46	29.0
P-360	E-4	TIME SW, EXT LT	\$539	0.44	\$19	0.42	29.0
P-360	A-2	DROP CEILING	\$26,918	36.21	\$796	0.38	34.6
P-676	A-1	STORM WINDOWS	\$3,871	5.05	\$111	0.37	35.6
P-360	A-1	STORM WINDOWS	\$2,098	1.09	\$24	0.15	89.5
P-673	E-5	PHOTO SWITCH, EXT	\$211	0.06	\$2	0.14	108.0

TOTAL			\$43,201	74.48	\$1,340	0.50	40.2

TABLE 4 BUILDING ENERGY END-USE ANALYSIS

(Sheet 1 of 4)

ANNUAL ENERGY CONSUMPTION (MBTU)

INSTALLATION	BLDG. NO.	DESCRIPTION	A/C	LIGHTING	D.H.W.	OTHER	TOTAL	S.F.	MBTU/SF	%
FT. SHAFTER										
	P-405	PRESENT USAGE	618.13	833.00	7.60	365.20	1823.93	29,206	0.062	100%
		SAVINGS BY ECO'S	49.90	3.86	0.00	0.00	53.76	29,206	0.002	3%
		PROJECTED USAGE	568.23	829.14	7.60	365.20	1770.17	29,206	0.061	97%
SCHOFIELD BKS.										
	P-844	PRESENT USAGE	965.05	1201.50	532.08	164.10	2862.73	22,291	0.128	100%
		SAVINGS BY ECO'S	382.10	38.37	0.00	0.00	420.47	22,291	0.019	15%
		PROJECTED USAGE	582.95	1163.13	532.08	164.10	2442.26	22,291	0.110	85%
P-672										
		PRESENT USAGE	0.00	177.20	3.17	56.70	237.07	14,100	0.017	100%
		SAVINGS BY ECO'S	0.00	17.01	0.00	0.00	17.01	14,100	0.001	7%
		PROJECTED USAGE	0.00	160.19	3.17	56.70	220.06	14,100	0.016	93%
P-673										
		PRESENT USAGE	453.89	217.60	4.22	376.90	1052.61	14,136	0.074	100%
		SAVINGS BY ECO'S	0.00	0.59	0.00	0.00	0.59	14,136	0.000	0%
		PROJECTED USAGE	453.89	217.01	4.22	376.90	1052.02	14,136	0.074	100%
P-676										
		PRESENT USAGE	101.42	161.00	5.28	74.80	342.50	9,840	0.035	100%
		SAVINGS BY ECO'S	20.10	0.00	0.00	0.00	20.10	9,840	0.002	6%
		PROJECTED USAGE	81.32	161.00	5.28	74.80	322.40	9,840	0.033	94%
P-677										
		PRESENT USAGE	0.00	156.00	1.06	34.50	191.56	14,400	0.013	100%
		SAVINGS BY ECO'S	0.00	8.20	0.00	0.00	8.20	14,400	0.001	4%
		PROJECTED USAGE	0.00	147.80	1.06	34.50	183.36	14,400	0.013	96%
P-678										
		PRESENT USAGE	276.65	164.70	212.83	395.20	1049.38	14,400	0.073	100%
		SAVINGS BY ECO'S	0.00	17.64	70.70	0.00	88.34	14,400	0.006	8%
		PROJECTED USAGE	276.65	147.06	142.13	395.20	961.04	14,400	0.067	92%

TABLE 4 BUILDING ENERGY END-USE ANALYSIS (SHT 2 of 4)

ANNUAL ENERGY CONSUMPTION (MBTU)

INSTALLATION	BLDG. NO.	DESCRIPTION	A/C	LIGHTING	D.H.W.	OTHER	TOTAL	S.F.	MBTU/SF	%
SCHOFIELD BKS. (CONTINUED)	P-679	PRESENT USAGE	0.00	126.00	0.00	15.70	141.70	6,531	0.022	100%
		SAVINGS BY ECO'S	0.00	0.00	0.00	0.00	0.00	6,531	0.000	0%
		PROJECTED USAGE	0.00	126.00	0.00	15.70	141.70	6,531	0.022	100%
	P-680	PRESENT USAGE	0.00	114.80	3.17	59.40	177.37	14,876	0.012	100%
		SAVINGS BY ECO'S	0.00	0.00	0.00	0.00	0.00	14,876	0.000	0%
		PROJECTED USAGE	0.00	114.80	3.17	59.40	177.37	14,876	0.012	100%
	P-681	PRESENT USAGE	0.00	225.90	1.06	9.00	235.96	11,270	0.021	100%
		SAVINGS BY ECO'S	0.00	0.00	0.00	0.00	0.00	11,270	0.000	0%
		PROJECTED USAGE	0.00	225.90	1.06	9.00	235.96	11,270	0.021	100%
	P-682	PRESENT USAGE	0.00	189.70	2.11	55.10	246.91	13,800	0.018	100%
		SAVINGS BY ECO'S	0.00	0.00	0.00	0.00	0.00	13,800	0.000	0%
		PROJECTED USAGE	0.00	189.70	2.11	55.10	246.91	13,800	0.018	100%
	P-683	PRESENT USAGE	27.05	132.30	0.00	9.00	168.35	6,580	0.026	100%
		SAVINGS BY ECO'S	0.00	0.00	0.00	0.00	0.00	6,580	0.000	0%
		PROJECTED USAGE	27.05	132.30	0.00	9.00	168.35	6,580	0.026	100%
	P-684	PRESENT USAGE	62.27	253.30	0.00	33.00	348.57	14,490	0.024	100%
		SAVINGS BY ECO'S	5.50	0.00	0.00	0.00	5.50	14,490	0.000	2%
		PROJECTED USAGE	56.77	253.30	0.00	33.00	343.07	14,490	0.024	98%
	P-685	PRESENT USAGE	0.00	225.90	2.11	10.80	238.81	13,500	0.018	100%
		SAVINGS BY ECO'S	0.00	0.00	0.00	0.00	0.00	13,500	0.000	0%
		PROJECTED USAGE	0.00	225.90	2.11	10.80	238.81	13,500	0.018	100%

TABLE 4 BUILDING ENERGY END-USE ANALYSIS (SHT 3 of 4)

ANNUAL ENERGY CONSUMPTION (MBTU)

INSTALLATION	BLDG. NO.	DESCRIPTION	A/C	LIGHTING	D.H.W.	OTHER	TOTAL	S.F.	MBTU/SF	%
SCHOFIELD BKS. (CONTINUED)	P-686	PRESENT USAGE	19.13	162.20	2.96	7.60	191.89	14,700	0.013	100%
		SAVINGS BY ECO'S	0.00	0.00	0.00	0.00	0.00	14,700	0.000	0%
		PROJECTED USAGE	19.13	162.20	2.96	7.60	191.89	14,700	0.013	100%
	P-687	PRESENT USAGE	0.00	169.70	0.00	11.50	181.20	14,700	0.012	100%
		SAVINGS BY ECO'S	0.00	12.88	0.00	0.00	12.88	14,700	0.001	7%
		PROJECTED USAGE	0.00	156.82	0.00	11.50	168.32	14,700	0.011	93%
	P-688	PRESENT USAGE	0.00	444.30	0.00	34.50	478.80	14,400	0.033	100%
		SAVINGS BY ECO'S	0.00	20.29	0.00	0.00	20.29	14,400	0.001	4%
		PROJECTED USAGE	0.00	424.01	0.00	34.50	458.51	14,400	0.032	96%
	P-691	PRESENT USAGE	38.70	102.30	0.00	16.80	157.80	4,390	0.036	100%
		SAVINGS BY ECO'S	0.00	0.00	0.00	0.00	0.00	4,390	0.000	0%
		PROJECTED USAGE	38.70	102.30	0.00	16.80	157.80	4,390	0.036	100%
	P-360	PRESENT USAGE	168.34	299.00	0.00	123.90	591.24	12,274	0.048	100%
		SAVINGS BY ECO'S	0.00	14.44	0.00	0.00	14.44	12,274	0.001	2%
		PROJECTED USAGE	168.34	284.56	0.00	123.90	576.80	12,274	0.047	98%
	P-584	PRESENT USAGE	169.20	86.90	0.00	155.10	411.20	9,331	0.044	100%
		SAVINGS BY ECO'S	0.00	0.00	0.00	0.00	0.00	9,331	0.000	0%
		PROJECTED USAGE	169.20	86.90	0.00	155.10	411.20	9,331	0.044	100%
	P-580	PRESENT USAGE	515.54	3513.00	0.00	100.40	4128.94	88,786	0.047	100%
		SAVINGS BY ECO'S	40.10	38.70	0.00	0.00	78.80	88,786	0.001	2%
		PROJECTED USAGE	475.44	3474.30	0.00	100.40	4050.14	88,786	0.046	98%

TABLE 4 BUILDING ENERGY END-USE ANALYSIS

ANNUAL ENERGY CONSUMPTION (MBTU) (Sheet 4 of 4)

INSTALLATION	BLDG. NO.	DESCRIPTION	A/C	LIGHTING	D.H.W.	OTHER	TOTAL	S.F.	MBTU/SF	%
FT. DeRUSSY	190	PRESENT USAGE	668.99	354.90	36.06	192.70	1252.65	27,245	0.046	100%
		SAVINGS BY ECO'S	69.60	114.56	0.00		184.16	27,245	0.007	15%
		PROJECTED USAGE	599.39	240.34	36.06	192.70	1068.49	27,245	0.039	85%
	191	PRESENT USAGE	98.38	110.70	0.00	15.50	224.58	17,140	0.013	100%
		SAVINGS BY ECO'S	11.20	38.03	0.00	0.00	49.23	17,140	0.003	22%
		PROJECTED USAGE	87.18	72.67	0.00	15.50	175.35	17,140	0.010	78%
	192	PRESENT USAGE	0.00	57.20	0.00	85.50	142.70	21,410	0.007	100%
		SAVINGS BY ECO'S	0.00	0.00	0.00	0.00	0.00	21,410	0.000	0%
		PROJECTED USAGE	0.00	57.20	0.00	85.50	142.70	21,410	0.007	100%
WHEELER AFB	1003	PRESENT USAGE	226.36	160.60	0.00	19.90	406.86	17,110	0.024	100%
		SAVINGS BY ECO'S	23.30	0.00	0.00	0.00	23.30	17,110	0.001	6%
		PROJECTED USAGE	203.06	160.60	0.00	19.90	383.56	17,110	0.022	94%
TOTAL		PRESENT USAGE	4,409.10	9,639.70	813.71	2,422.80	17,285.31	440,906	0.039	100%
		SAVINGS BY ECO'S	601.80	324.57	70.70	0.00	997.07	440,906	0.002	6%
		PROJECTED USAGE	3,807.30	9,315.13	743.01	2,422.80	16,288.24	440,906	0.037	94%
TOTAL		ELECTRICITY			SNG		LPG		TOTAL	
		MBTU/YR	\$/YR	MBTU/YR	\$/YR	MBTU/YR	\$/YR	MBTU/YR	\$/YR	
		PRESENT USAGE	16,479.20	\$362,048	770.05	\$7,562	36.06	\$349	17,285.31	\$369,959
	SAVINGS BY ECO'S	926.37	\$20,352	70.70	\$694	0	\$0	997.07	\$21,046	
	PROJECTED USAGE	15,552.83	\$341,696	699.35	\$6,868	36.06	\$349	16,288.24	\$348,913	

BUILDING ENERGY END-USE

PRESENT, ECO SAVINGS & PROJECTED

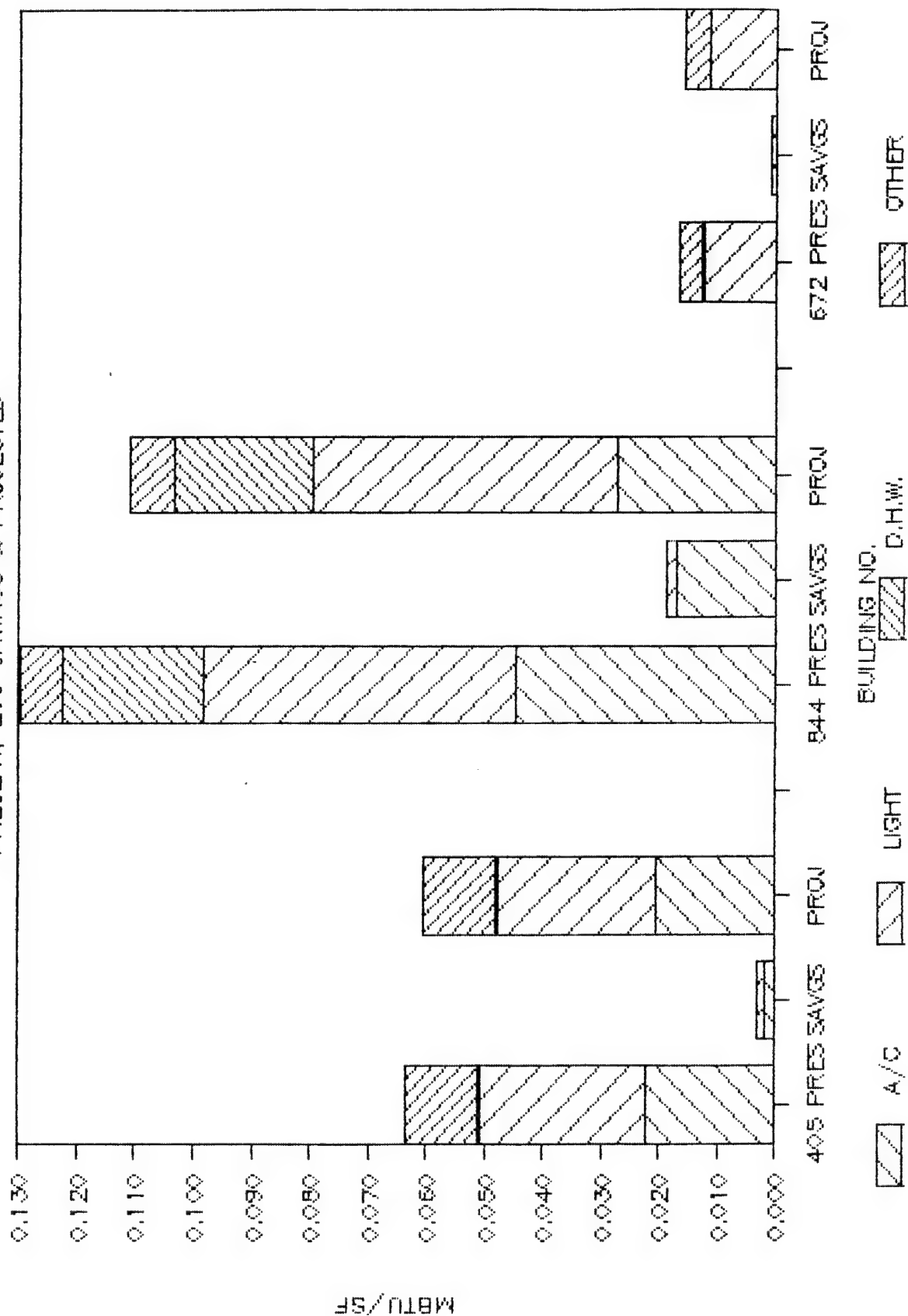


FIGURE 1 (SHEET 1 of 12)

BUILDING ENERGY END-USE

PRESENT, ECO SAVINGS & PROJECTED

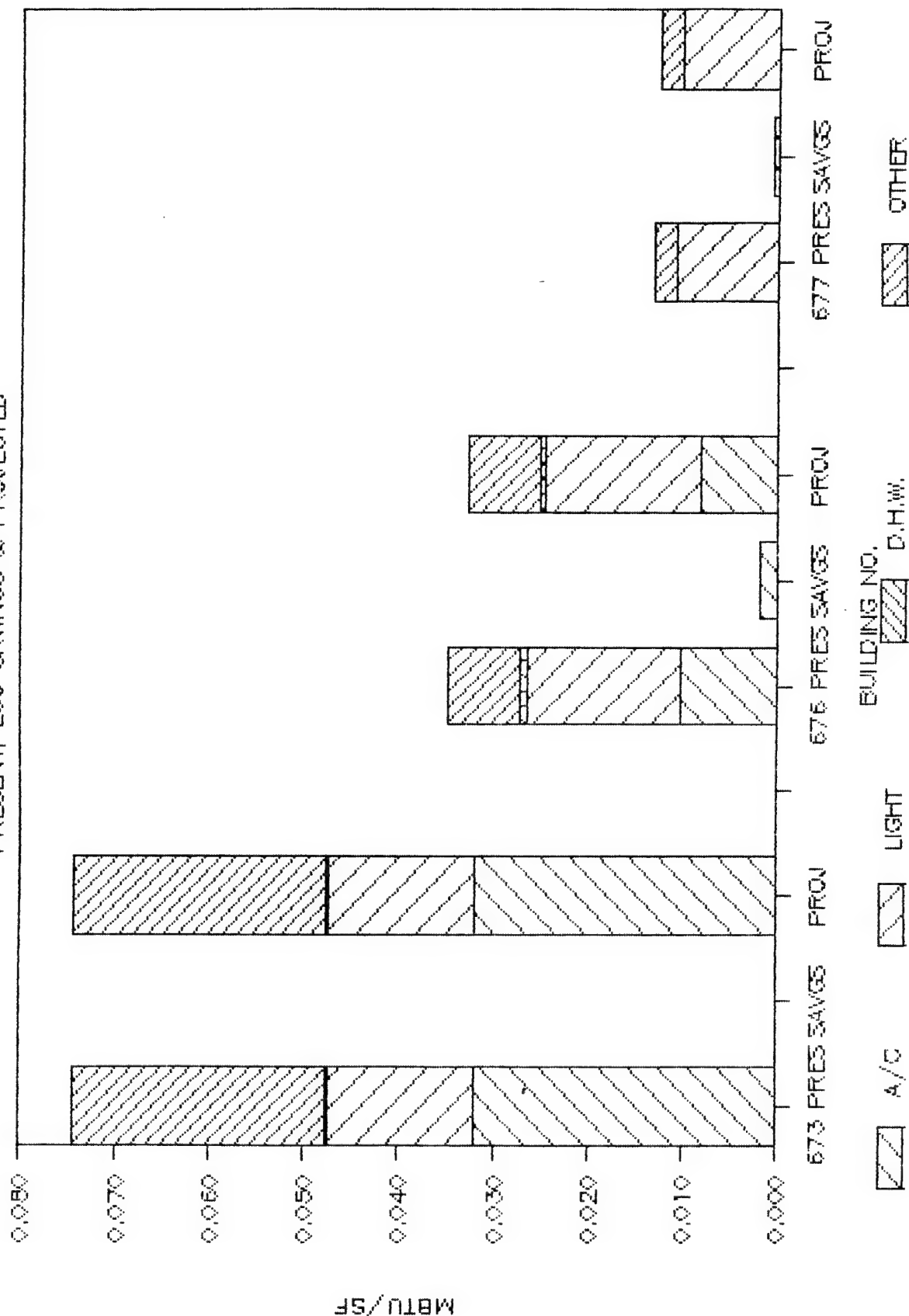


FIGURE 1 (SHEET 2 of 12)

BUILDING ENERGY END-USE

PRESENT, ECO SAVINGS & PROJECTED

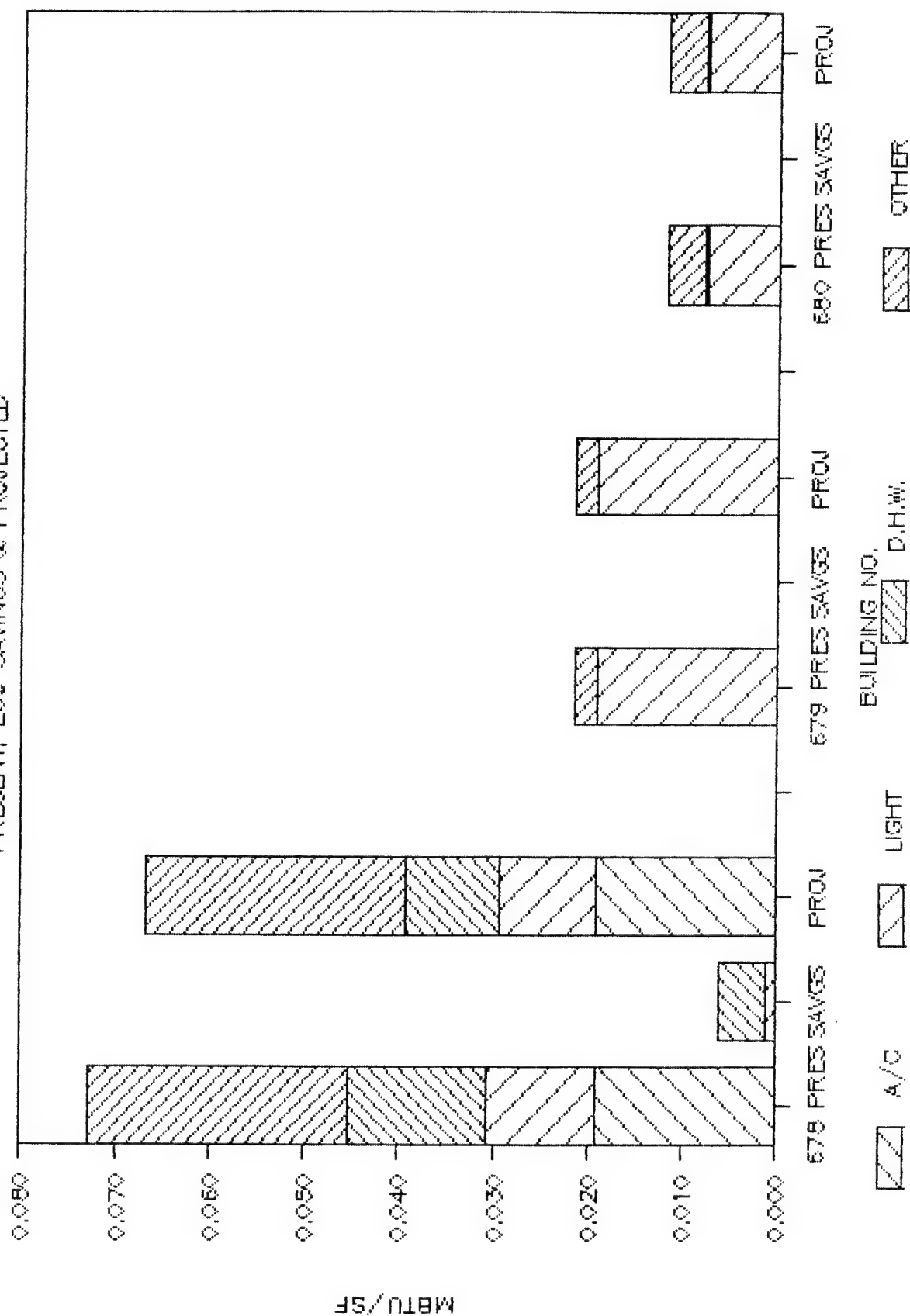


FIGURE 1 (SHEET 3 of 12)

BUILDING ENERGY END-USE

PRESENT, ECO SAVINGS & PROJECTED

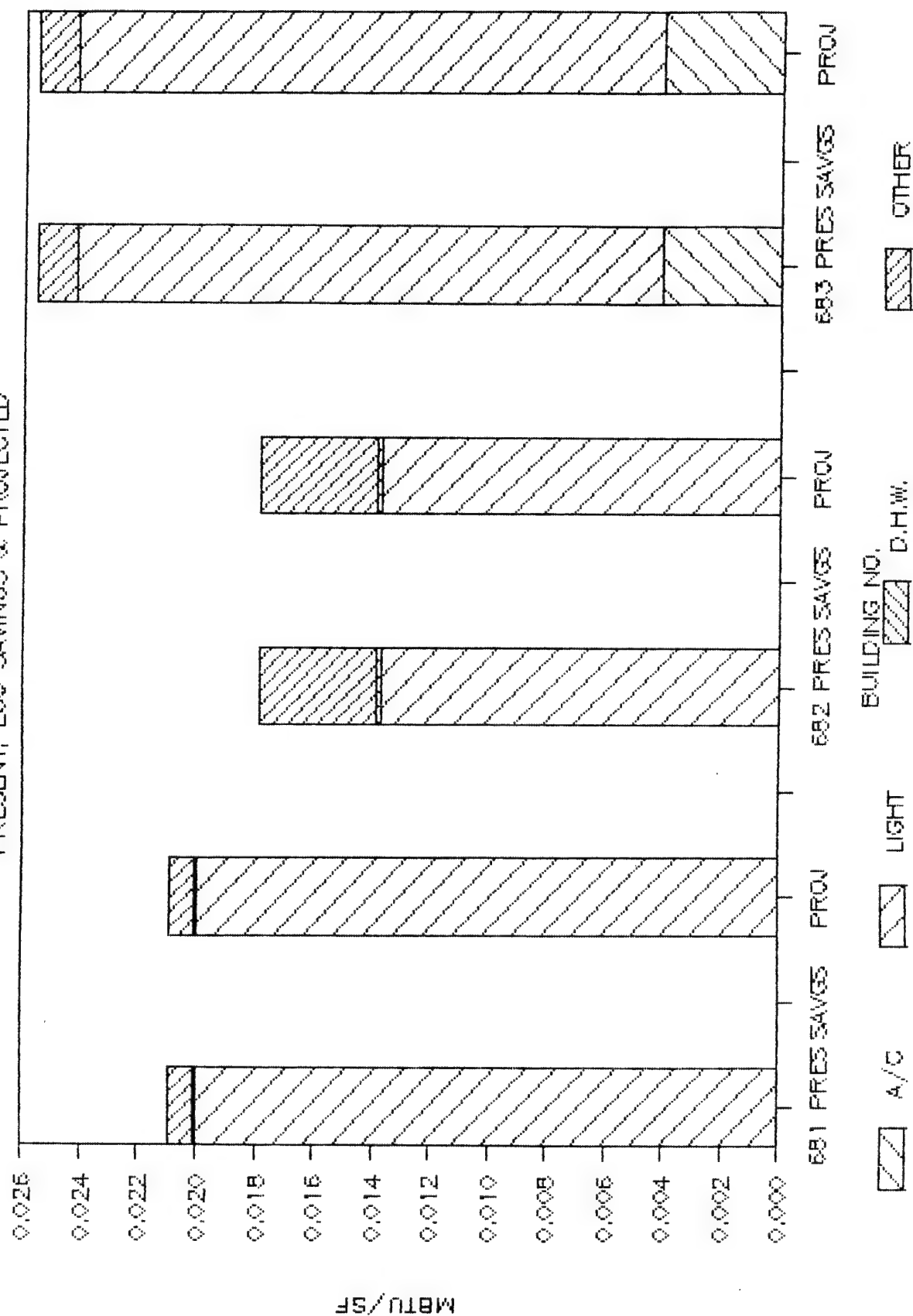


FIGURE 1 (SHEET 4 of 12)

BUILDING ENERGY END-USE

PRESENT, ECO SAVINGS & PROJECTED

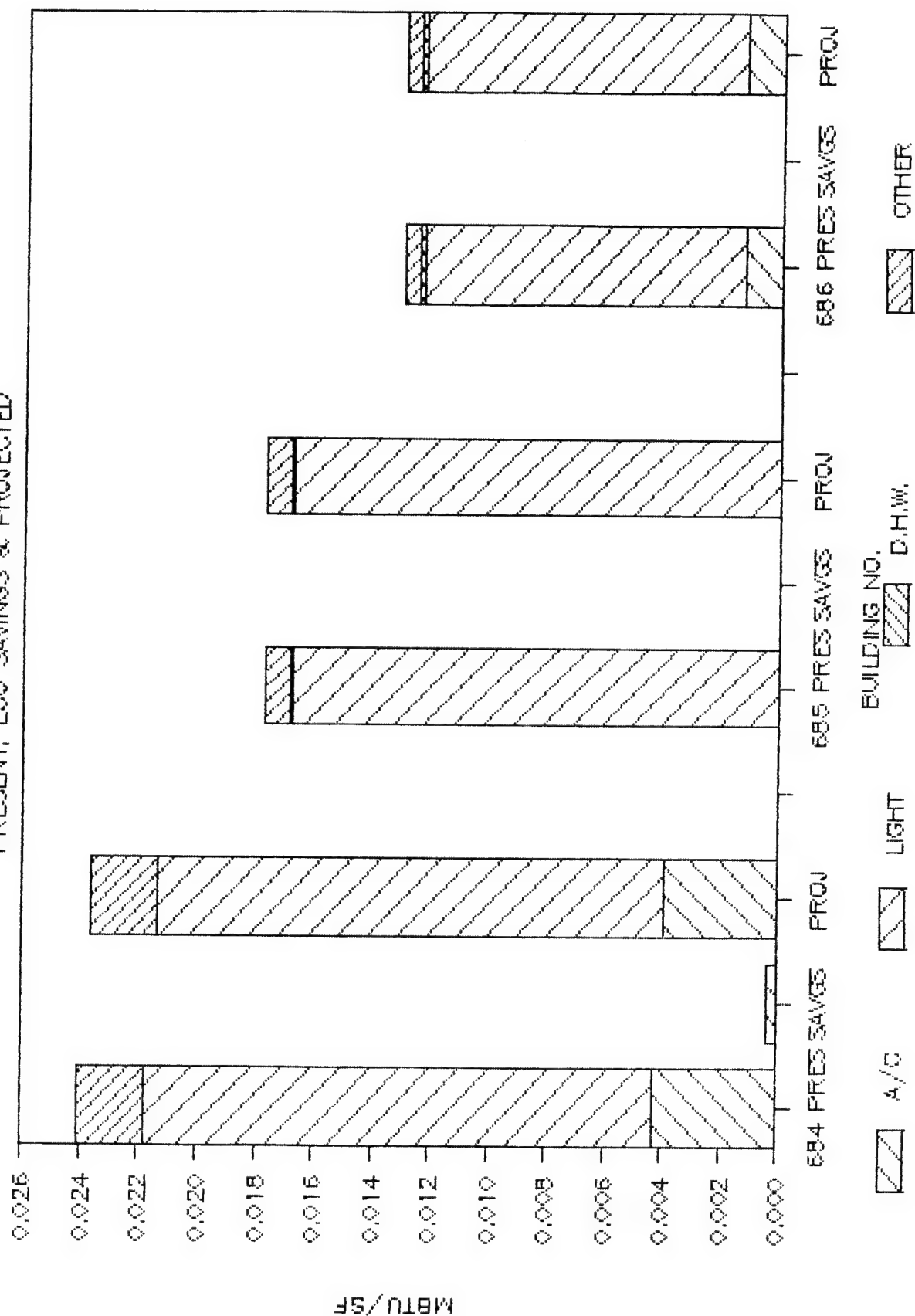


FIGURE 1 (SHEET 5 of 12)

BUILDING ENERGY END-USE

PRESENT, ECO SAVINGS & PROJECTED

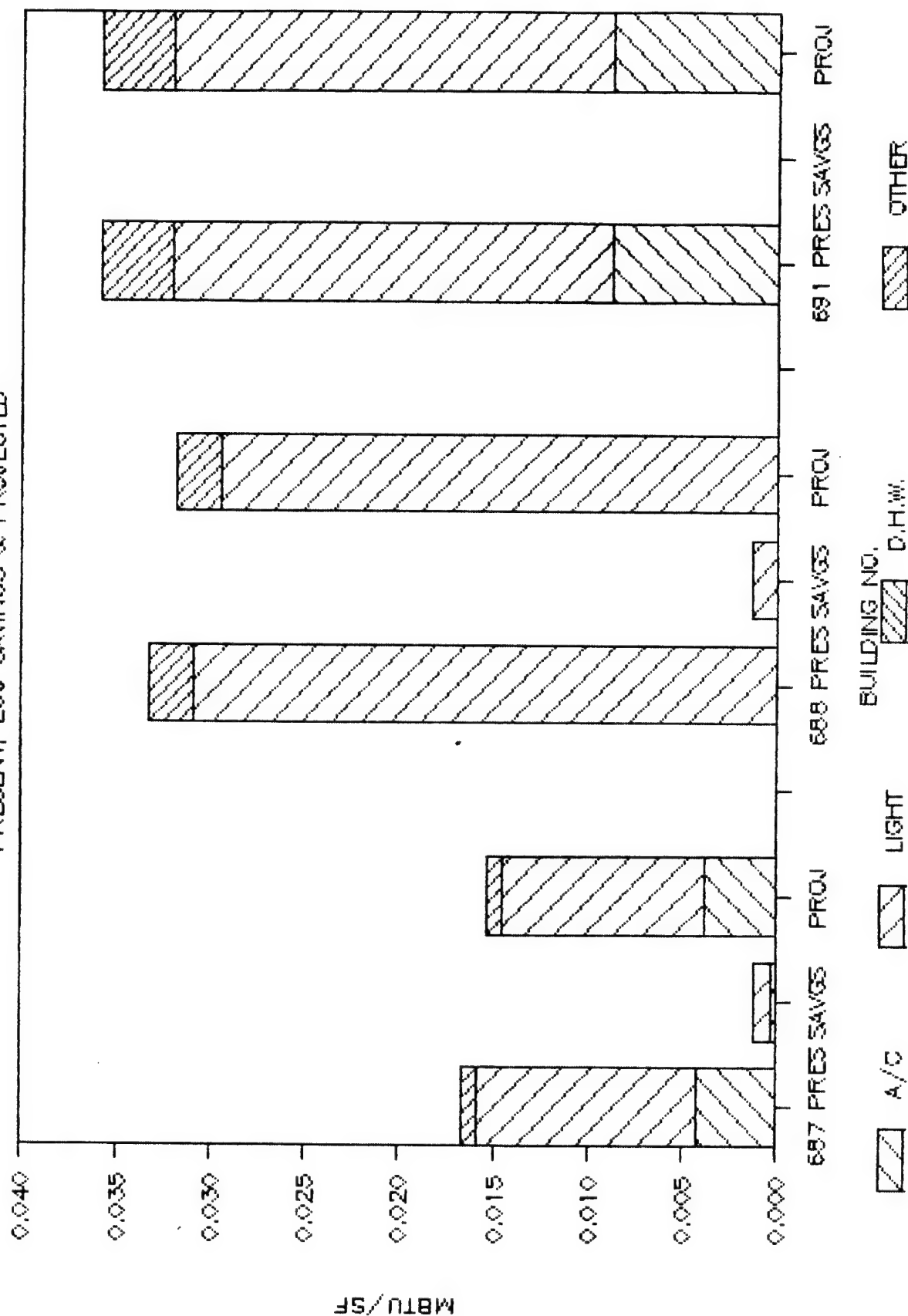


FIGURE 1 (SHEET 6 of 12)

BUILDING ENERGY END-USE

PRESENT, ECO SAVINGS & PROJECTED

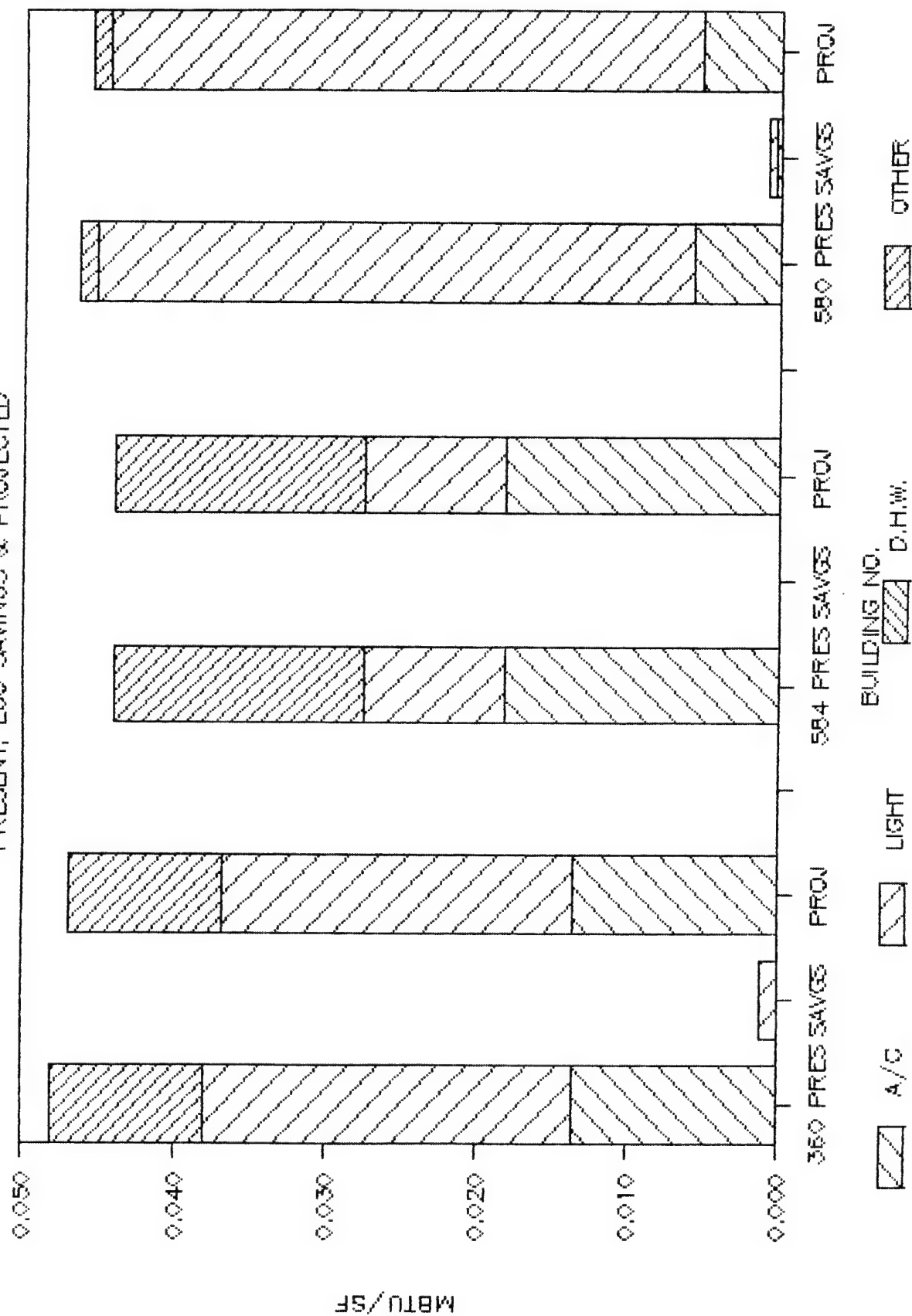


FIGURE 1 (SHEET 7 of 12)

BUILDING ENERGY END-USE

PRESENT, ECO SAVINGS & PROJECTED

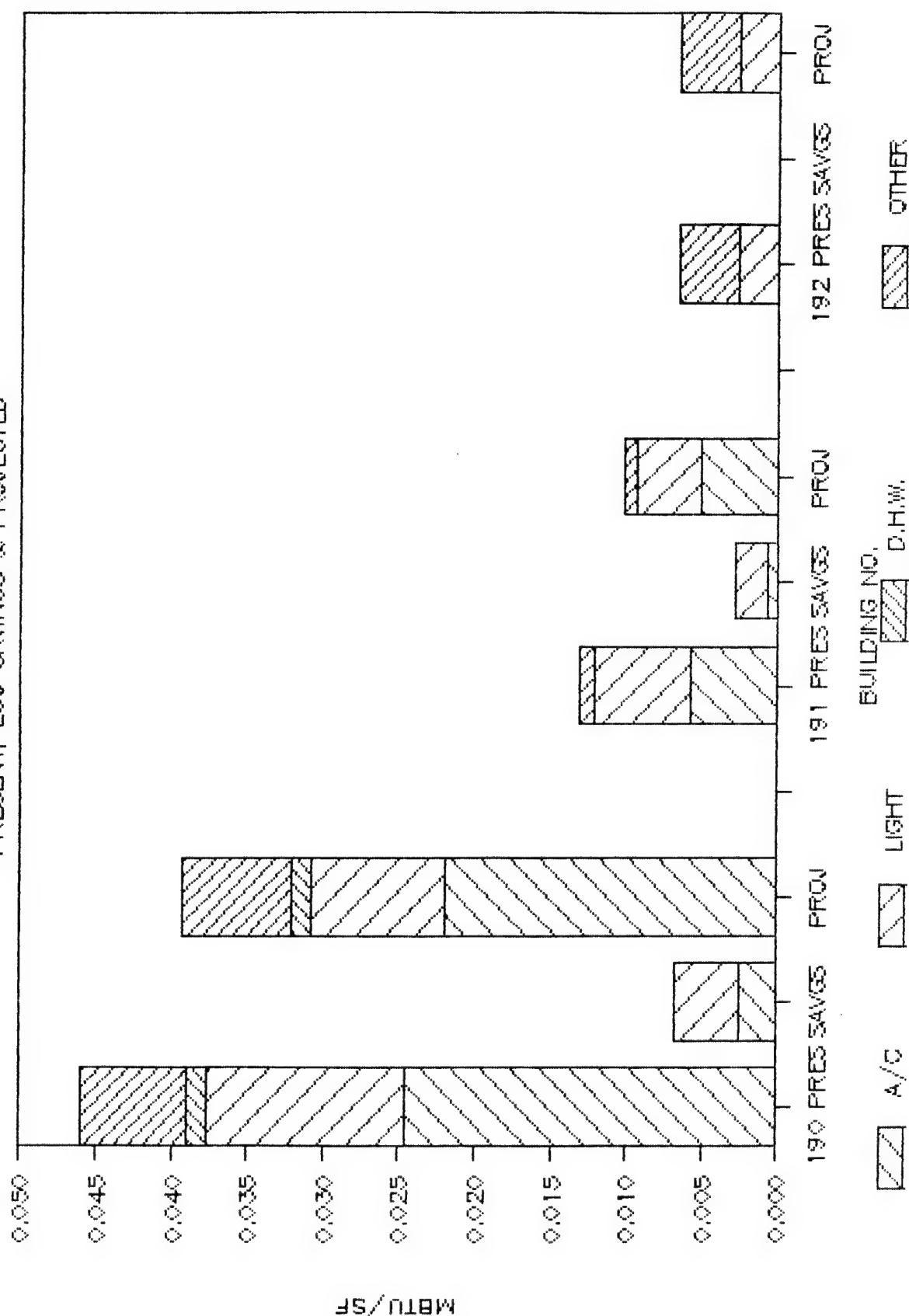


FIGURE 1 (SHEET 8 of 12)

BUILDING ENERGY END-USE

PRESENT ECO SAVINGS & PROJECTED

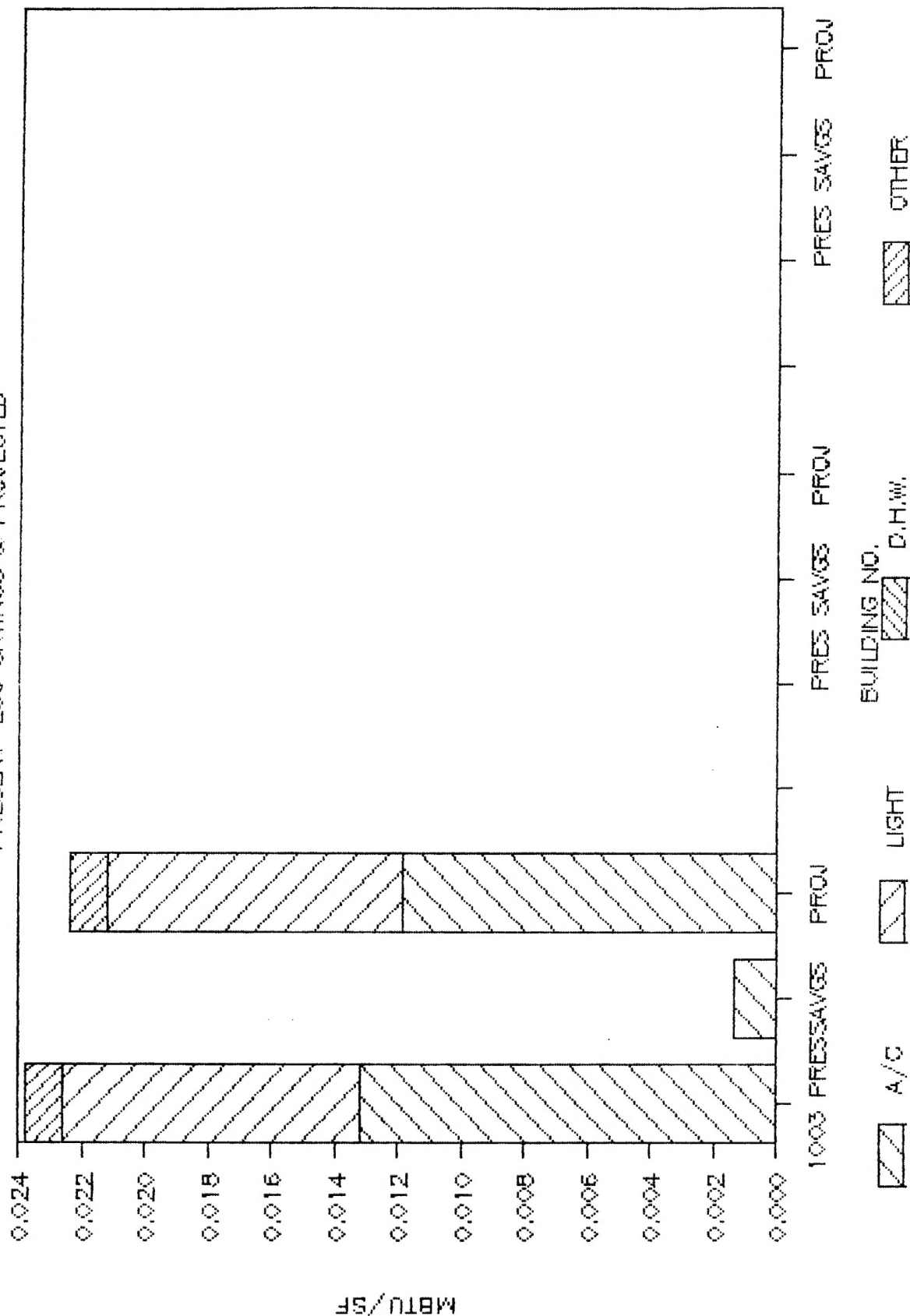
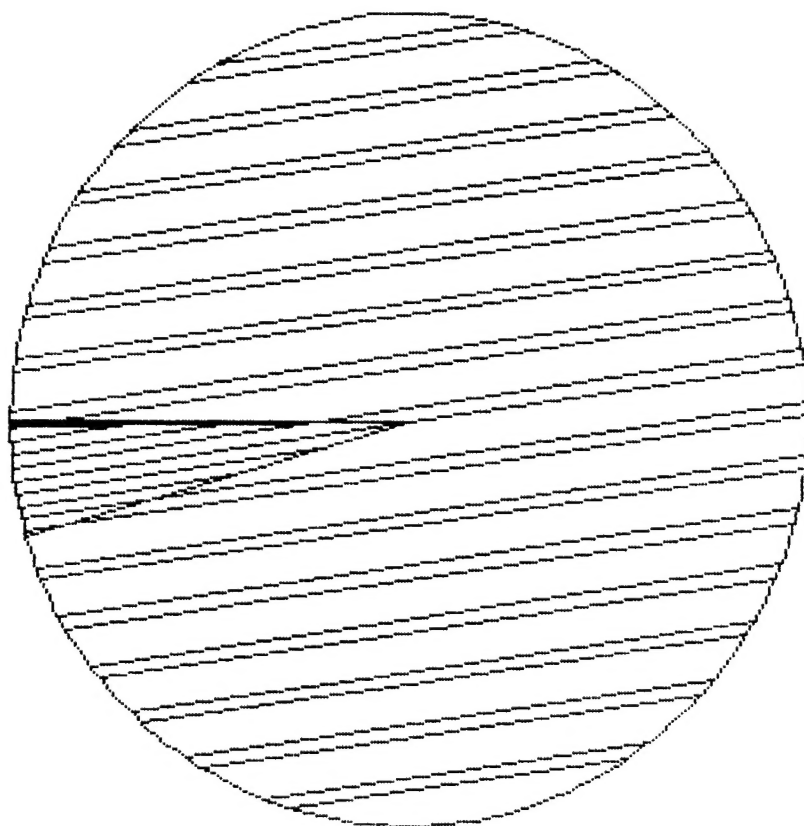


FIGURE 1 (SHEET 9 of 12)

BUILDING ENERGY END-USE

PRESENT ENERGY CONSUMPTION

SNG (4.5%)	LPG (0.2%)
770.05 MBTU/YR	36.06 MBTU/YR
\$7,562/YR	\$349/YR



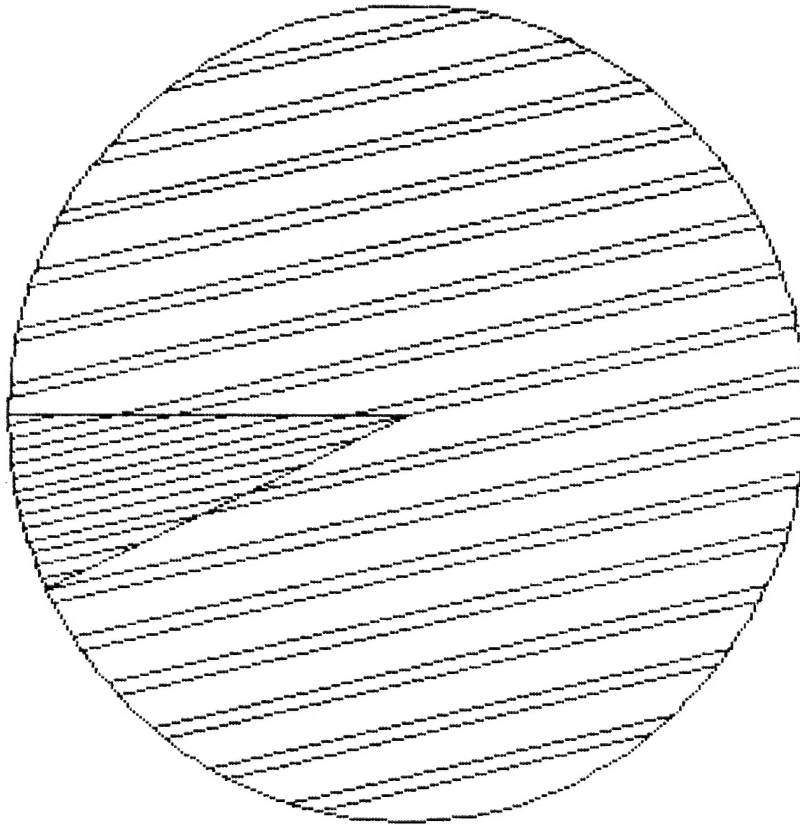
(ELECTRICITY (95.3%))
16,479.20 MBTU/YR
\$362,048/YR

FIGURE 1 (SHEET 10 of 12)

BUILDING ENERGY END-USE

ECO'S ENERGY SAVINGS

SNG (7.1%) LPG (0.0%)
70.70 MBTU/YR 0 MBTU/YR
\$694/YR \$0/YR



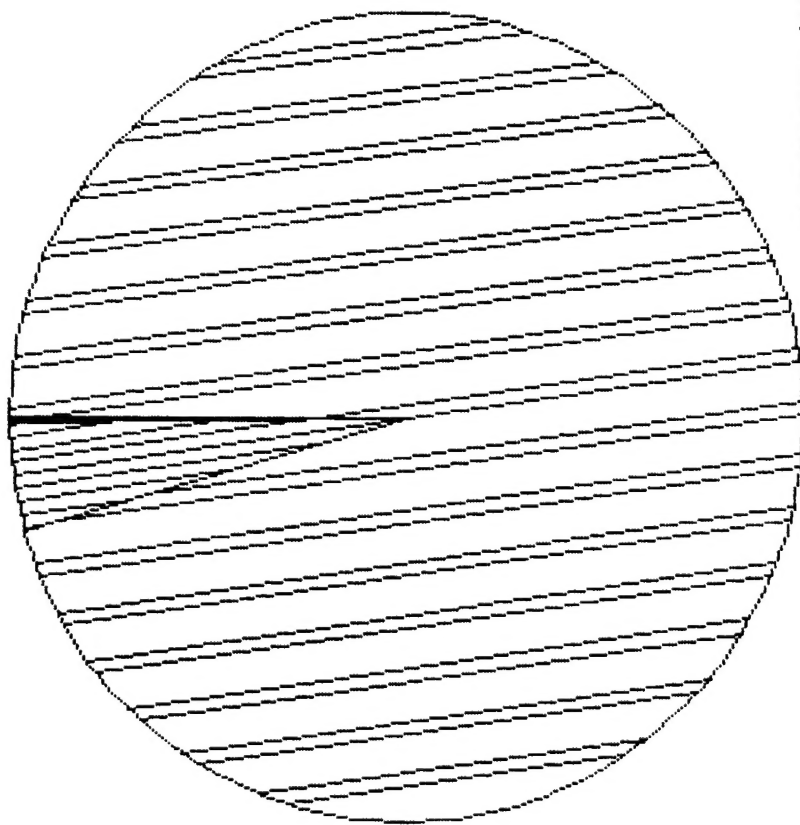
ELECTRICITY (92.9%)
926.37 MBTU/YR
\$20,352/YR

FIGURE 1 (SHEET 11 of 12)

BUILDING ENERGY END-USE

PROJECTED ENERGY CONSUMPTION

SNG (4.3%)	LPG (0.2%)
699.35 MBTU/YR	36.06 MBTU/YR
\$6,868/YR	\$349/YR



ELECTRICITY (95.5%)
15,552.83 MBTU/YR
\$341,696/YR

FIGURE 1 (SHEET 12 of 12)